DOCUMENT RESUME

ED 041 251 | 24 | AL 002 083

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TITLE	The Interaction of Sentence Characteristics and Mode of Presentation in Recall (Sentences and Mode of Presentation).
INSTITUTION	National Laboratory on Early Childhood Education, Chicago, Ill. Early Education Research Center.
SPONS AGENCY	Department of Health, Education, and Welfare, Washington, D.C. National Center for Educational Research and Development.; Michigan Univ., Ann Arbor. Dept. of Psychology.
REPORT NO	Doc-70706-WG(5)
BUREAU NO	BR-7-0706
PUB DATE	[68]
CONTRACT	OEC-3-7-070706-3118
NOTE	18p.
EDRS PRICE	EDRS Price MF-$0.25 HC-$1.00
DESCRIPTORS	*Language Research, *Psycholinguistics, *Recall (Psychological), Research Methodology, *Sentence Structure, Syntax, Tape Recordings, Transformations (Language)
IDENTIFIERS	*Underdeterminacy

ABSTRACT

It has been demonstrated (in the research described here) that people hearing sentences on a tape recording process underdetermined sentences differently than people hearing them in a conversation. It has been shown that this difference is caused by the presence of underdetermined elements but not ordinary transformations. The effect of ordinary transformations in both modal and non-modal sentences is the same in both conditions. The possibility that the effective factor here is condition alone or underdeterminacy alone has been ruled out. Instead an interaction between condition and sentence type has been demonstrated. The demonstrated interactions was predicted from the nature of underdeterminacy. Underdetermined elements are any elements whose main function is to convey information about the state of a speaker by injecting that information into an otherwise purely factual proposition. Hence, these elements should not have their real meaning in the absence of a speaker. Results from counting equivalent and non-equivalent substitutions along with other findings suggest that subjects in conventional tape experiments do not attend to sentence meaning to the same extent as do subjects in ordinary conversations. It may well be that earlier findings can be attributed to the unnatural importance of syntax in a tape experiment. (Author/AMM)

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Document 70706-WG(5)

ED041251

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The research or work reported herein was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education, and Welfare through the Chicago Early Education Research Center, a component of the National Laboratory on Early Childhood Education, Contract OEC-3-7-070706-3118.

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THE INTERACTION OF SENTENCE CHARACTERISTICS AND MODE OF PRESENTATION IN RECALL[1, 2]

(Sentences and Mode of Presentation)

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[1]This research is supported by NECHD grant number P01 HD 01368, OE grant number 3-7-0707-6-3118, and by the Psychology Department, University of Michigan.

[2]Gratitude is expressed to Dr. David McNeill for his generous help.

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The present experiments are intended to test the hypothesis that ordinary sentences heard in conditions approximating those of an ordinary conversation will be processed differently than will the sorts of sentences typically used in experiments when heard in typical experimental conditions, i.e., on tape recordings. In particular, it is possible to manipulate context experimentally so as to minimally approximate the important parameters of ordinary conversational conditions, by having the person uttering the sentences actually be present and by having the subject reply briefly to each sentence. It was expected that the relation between difficulty of processing with increasing functional complexity demonstrated by studies such as Miller (1962) would be replicated in a tape condition but would not appear in a conversation condition.

Insofar as sentence structure approximates that found in ordinary conversation, it should also affect processing. In particular, the kernel plus transformation structure commonly employed in psycholinguistic experiments should not elicit the complex processing mechanisms characteristic of ordinary speech processing, because such minimally meaningful structures as the transformations which are commonly used, when combined with kernel of no information value, do not tend to involve the hearer. He does not try to understand the meaning of such sentences partly because the structures are minimally meaningful and partly because there is no one to whom he can attribute the intent to mean something in particular in a tape condition. There are several linguistic devices which can be used by a speaker to inject

his attitudes about a proposition into a sentence. Among them are modals (Jesperson, 1958), "even" (Livant, 1960-66) and "only." It was intended to show that such devices are processed differently than ordinary transformations but only in conversational conditions. In a tape condition in the absence of a speaker, such structures would not be understood as they would be if heard in an ordinary conversation, and hence they would be processed like any language structure of minimal meaning, i.e., like the ordinary transformations (negation, passivization, etc.). Of course, this is an oversimplification in the sense that even the various transformations here called "ordinary" are different from one another.

Among the minimal conditions, then, for the study of meaning will be that processing occur in conditions which approximate those of ordinary conversations. Further, the nature of the language structures built into experimental sentences will make some difference. Certain kinds of operators will tend to make sentences more meaningful than others provided the sentences are presented in a conversation condition.

Experiment I

Method

In this experiment the main group of subjects were presented with modal sentences of varying degrees of transformational complexity in tape and conversation conditions. All subjects were run individually and heard the sentences in groups of eight, all of the same structural type. Subjects

were required to recall as many as possible of the eight sentences in each group as they could after hearing them once.

Subjects

Twenty subjects were used in both the tape and conversation condition of the main experiment, half of whom were male and half female. The subjects were students at the University of Michigan who were paid $1.25 for one hour's participation.

Conditions

For the tape condition sentences were recorded (by a person unfamiliar with the hypotheses being examined) on 1/2 mm. tape on a Craig tape recorder. Three seconds of silence were recorded between successive sentences in a group and two and a half minutes of silence were recorded between the groups. The latter interval was sufficiently long for the recall task. Every effort was made to make the intonation of the sentences monotonous and the pronunciation as clear as possible.

In the conversation condition, sentences were read one at a time by a paid experimental accomplice from a list presented to him by the experimenter in the presence of the subject. The accomplice also made the tape for the tape condition; he spoke in the same monotonous and somewhat artificial manner in the conversation condition as he did on the tape. The subject was instructed to reply briefly after hearing each sentence without repeating the stimulus sentence. At the end of a group of eight sentences, the accomplice

appeared to participate in the recall task and to be, for all practical purposes, a returning subject. The subject was told at the outset that the experiment involved making up conversational replies to sentences which had occurred freely in an earlier experiment in which the accomplice was a subject. In the presence of the subject, the accomplice was instructed to speak as conversationally as possible. The subject was instructed to reply as conversationally as possible. The subject was instructed that there were eight sentences in a group and six groups of sentences as in the tape condition.

Stimulus Materials

There were six groups of eight sentences presented. Basic sentences were first constructed and the different structural types were generated from these. The basic sentences consisted of a subject selected from a list of nominalized activities that any person can participate in at some time and familial relationships. For instance, "driver," "reader," and "sister." The sentence was followed by an appropriate verb form which takes a predicate complement (usually a direct object). For instance, "turned," "heard," and "spilled." The sentence was completed with a noun that was selected because of its good fit with the subject and verb so that the whole sentence would be plausible. For instance, "corner," "introduction," and "milk." No subject, verb, or object appears in more than one sentence with three exceptions which are controls.

One group of eight sentences was left intact: this is the "neutral" group. For the main experiment a modal was added to the verb of all of the

remaining sentences. One word from a list of eight modals and "quasi-modals" was added to each sentence in a group so that all of the modals appear in each group, and no modal appears more than once in any given group. The list of modals consists of: should + have, would + have, might + have, may + have, could + have, must + have, seems to + have, ought to + have.

For the groups including "even" and "only" (modal + even or only; modal + negative + even or only), one of these two operators was systematically added to either the subject, the verb, or the complement of each sentence. For the groups which included additional transformations, the appropriate transformations were included. In this manner six sentence groups were generated: Neutral (P), Modal (M), Modal plus Even or Only (M + O), Modal plus Negative (M + N), Modal plus Even or Only plus Negative (M + N + O), and Modal plus Negative plus Question (M + N + Q). Groups were preserved in presentation.

Since the subject, verb, and object are the common denominator across all of the different sentence types, sentences will be considered to be correctly recalled when at least the subject, verb, and object are correctly recalled.

Results

The mean correct recall in each of the two conditions for each of the various sentence groups, excluding for the moment M+N+Q, are given in Table 1. In the tape condition the sentence groups are significantly different from one another ($F = 3.31$, $p < .02$). Treating the five groups as representative of three levels of complexity: P and M, M+N and M+O, and M+N+O,

there is a significant linear trend ($F = 6.85$, $p < .02$). Hence, there is a decrement with increasing sentence complexity in the tape condition. There is, however, a strong difference between conditions in recall of the various sentence groups, since in the conversation condition the groups did not differ significantly from one another ($F = 1.6$). In fact, in the conversation condition recall for all sentence groups except M+N was almost identical.

Insert Table 1 about here

The group M+Q+N was recalled a mean of 3.4 times in the tape condition. It was recalled better than sentence groups of equal complexity (M+O+N, 2.8) and groups of less complexity (M+N, 3.0; M+O, 3.1). The difference between the recall of M+O+N and M+Q+N which are of equal complexity was tested in a t-test. The difference was not found to be significant ($t = 1.74$, $p < .10$). In the conversation condition, M+Q+N was recalled a mean of 3.2 times. In contrast, the U values show significant differences between the conditions for the sentence groups M+O (with the correction for ties applied $Z = 1.63$, $p < .05$) and M+O+N ($Z = 1.9$, $p < .02$). Hence, there is a difference in recall between the tape and conversation conditions for the multipli-underdetermined sentences but not for singly underdetermined sentences.

The difference between recall in the tape and conversation conditions can be explained in terms of a differential effect of underdetermined elements on recall in the two conditions. This differential effect can best be seen by contrasting recall for singly and, the structurally more complex, multipli-underdetermined sentences in the two conditions. The additional

underdetermined elements should cause a decrement in the tape condition because they add complexity, but no decrement in the conversation condition because they increase underdeterminacy at the same time in that condition. In the tape condition singly underdetermined sentences M and M+N are recalled a mean of 3.6 times. Recall of multipli-underdetermined sentences M+O and M+O+N shows a decrement to a mean recall of 3.0. In the conversation condition the situation is reversed. The singly underdetermined sentences are recalled a mean of 3.2 times, but recall of multipli-underdetermined sentences shows an increment to a mean recall of 3.6.

It has been shown that adding underdetermined elements to modal sentences has a differential effect on recall in the two conditions. To show that this decrement is caused by the particular nature of the interaction of underdetermined elements it must be shown that adding non-modal operators (ordinary transformations) to modal sentences does not have a differential effect on the two conditions.

This can be demonstrated for sentences of two different levels of complexity: M and M+N. A comparison of recall in the two conditions with the addition of a negative (M vs. M+N) shows a decrement in both conditions. In the tap condition the decrement is from a mean of 4.1 to a mean of 3.0 correct recalls, and in the conversation condition from a mean of 3.6 to a mean of 2.9. Furthermore, adding an interrogative to M+N (M+N vs. M+Q+N) also has the same effect on both conditions. The size and direction of change is the same in the two conditions. In the tape condition M+N is

recalled a mean of 3.0 times while M+Q+N is recalled a mean of 3.4 times, and in the conversation condition M+N is recalled a mean of 2.9 times while M+Q+N is recalled a mean of 3.2 times. Hence, adding negation or a question transformation has the same effect on recall in both conditions.

This effect contrasts sharply with the effect of adding "only" to these sentences. Here the addition has a different effect on each of the two conditions. Adding "only" to a modal sentence (M) causes a recall decrement in the tape condition and an increment in the conversation condition. In the tape condition sentence group M is recalled a mean of 4.1 times while group M+O is recalled a mean of 3.1 times. In the conversation condition group, M is recalled a mean of 3.6 times but group M+O is recalled 3.7 times. The same differential is found when "only" is added to the more complex group M+N. Again there is a decrement in the tape condition and an increment in the conversation condition. In the tape condition the sentence group M+N is recalled a mean of 3.0 times while the sentence group M+O+N is recalled a mean of 2.8 times. In the conversation condition the group M+N is recalled 2.9 times but the group M+O+N is recalled 3.6 times.

It has been shown for modal sentences that the addition of underdetermined elements has a differential effect on recall in the two conditions. This is true despite the fact that the addition of ordinary transformations (negation and question) has the same effect on the two conditions.

One could still ask, however, whether the difference found between the conditions with the addition of underdetermined and nonunderdetermined

elements is specific to modal sentences. It has been shown that there is a difference between conditions when underdetermined elements are added to modal sentences but that there is no difference when an ordinary transformation is added to modal sentences. That there is no difference between conditions when an ordinary transformation is added to ordinary (nonunderdetermined) sentences will be shown in Experiment II.

Incorrect responses were categorized in various ways (Tables 1 and 2). There is a greater number of incomplete responses in the tap condition (53) than in the conversation condition (4), and a greater number of unrecognizable responses in the tape condition (37) than in the conversation condition (15); however, the number of equivalent responses is greater in the conversation condition (32) than in the tape condition (5). (See Table 2.) This combination of findings suggests that in the tape condition subjects tend to concentrate on the particular words in the stimulus sentences, whereas in the conversation condition the subjects pay more attention to the meaning of the sentence.

Insert Table 2 about here

Responses often included substitutions. These were classified as meaning-preserving (equivalent) and meaning-changing (error) substitutions. The total number of substitutions is greater in the conversation condition (102) than in the tape condition (78). The difference consists of meaning-preserving (equivalent) substitutions, as the number of error substitutions

is approximately the same in the two conditions--33 in the tape condition, 28 in the conversation condition. The number of equivalent substitutions is, however, greater in the conversation condition (74) than in the tape condition (45). (See Table 3.) Again, the difference suggests that subjects in the conversation condition attended primarily to meaning, whereas the subjects in the tape condition attended primarily to surface form.

Insert Table 3 about here

Experiment II

In the control experiment the stimulus sentences included neutral, negative, interrogative, and negative plus interrogative sentences. Subjects were asked to recall in both the tape and conversation conditions. Subjects were presented with non-modal sentences of various degrees of transformational complexity in the two conditions. There were ten subjects in each condition, half female and half male. Subjects were students at the University of Chicago and were not paid for their participation. Instructions for the two conditions were the same as in the main experiment. Sentences were constructed by the same procedure as in the main experiment and consisted of the sentence groups: Neutral, Negative, Interrogative, and Negative plus Interrogative. There were eight sentences in each group.

Recall of each of the four sentence groups was the same in both conditions. The four Mann-Whitney U tests show no difference between conditions for any of the sentence groups (Table 4).

Insert Table 4 about here

For n= 10, the hypothesis of no difference cannot be rejected unless U is less than or equal to 23.

Discussion

It has been demonstrated that people hearing sentences on a tape recording process underdetermined sentences differently than people hearing them in a conversation. It has been shown that this difference is caused by the presence of underdetermined elements but not ordinary transformations. The effect of ordinary transformations in both modal and non-modal sentences is the same in both conditions.

The possibility that the effective factor here is condition alone or underdeterminacy alone has been ruled out. Instead an interaction between condition and sentence type has been demonstrated. The marked effect of underdetermined elements only emerges in the conversation condition, and recall of subjects in the two conditions is only different for multipli-underdetermined sentences.

The demonstrated interaction was predicted from the nature of underdeterminacy. Underdetermined elements are any elements whose main function is to convey information about the state of a speaker by injecting that information into an otherwise purely factual proposition. Hence, these elements should not have their real meaning in the absence of a speaker. Furthermore, since non-underdetermined sentences are not fully

communicative linguistic units in the sense considered here, they should not be enhanced by presentation in a conversational context.

Two important properties of ordinary speech--context and sentence type--have been found to interact affecting behavior in ways that would not have been predicted by any current psycholinguistic theory. Perhaps more important in the long run, it has been shown that basic parameters of the ordinary conversational situation are amenable to experimental manipulation. Neither parameter manipulated by itself shows any difference in performance from that observed in earlier studies. The communicative system can be broken into parts and controlled for experimental purposes, but for it to be effective its basic structure must be preserved.

Finally, the results from counting equivalent and non-equivalent substitutions along with other findings suggest that subjects in conventional tape experiments do not attend to sentence meaning to the same extent as do subjects in ordinary conversations. It may well be that earlier findings and the models of meaning built upon those findings can be attributed to the unnatural importance of syntax in a tape experiment where people are unable to attend to important aspects of meaning.

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Table 1

Mean Number of Correct Recalls of the Modal Sentence Groups

Condition	Sentence Groups N	M	M+O	M+N	M+O+N
Tape	3.7	4.1	3.1	3.0	2.8
Conversation	4.0	3.6	3.7	2.9	3.6
U =	186.5	155.	141.	188.	134.

Table 2

Incorrect Responses

Condition	Incomplete	Unrecognizable	Equivalent
Tape	53	37	5
Conversation	4	15	32

Table 3

Substituted Responses

Condition	Equivalent Substitutions	Error Substitutions	Total
Tape	45	33	78
Conversation	74	28	102

Table 4

Mean Number of Correct Recalls of Ordinary Transformed Sentences

Condition	Neutral	Question	Negative	Negative + Q
Tape	3.5	2.9	4.2	4.2
Conversation	3.2	2.4	4.4	3.8
U =	44.5	37.5	49.5	35.4